COPYRIGHT PROTECTION FOR VIRUS AUTHORS

Establishing Protection for Authors Irrespective of the Merits of Their Creation

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Deadline for submission: (01.12.2010):

Number of words: 17,036 (max. 18.000)

01.12.2010

Content

1 Thesis Focus

1.1 Why copyright

Knowledge consumption in our modern world has moved from the physical into the digital. Copyright has likewise expanded into this digital realm to mirror existing protections based on its physical traditions. This protection originated centuries ago to strike a limited balance of reserving an author's financial rights while sponsoring societal advancement in consuming new works. (Deazley, 2006) Prior to this legal protection, authors were subject to profiteering by booksellers who could take advantage of their dominant position to print books without equitably compensating the author. (Loewenstein, 200)

In our modern digital world, a similar situation has come into existence, not due to a lack of protection but instead due to a lack of acknowledgement. Authors of software viruses possess the same protection as any other author and yet, society is roundly ignoring misappropriation of their creative work for commercial gain. This thesis contends that, much like booksellers of old, anti-virus companies' appropriate others original material for their own commercial purposes without any due consideration for the rights of its author.

The illegality of virus activity is contained in many international and national legal regimes however, that applies to the use of a virus. Copyright enactment is to protect the inherent interests of an author based on recognition, economic opportunity and as a contribution to society: not legality of action. (Berne) The intention of a protected work is not a consideration since the stated purposes of copyright are to encourage new authorship by applying protection at creation. (Bainbridge, 2006) Whether a nation finds the work illegal or immoral is a matter left to individual nations, but the work must first exist to make that determination.

This thesis establishes copyright as a protection granted by society, which contains provisions to allow a nation to restrict protection: so long as it comports with the overall intention of copyright. (Berne) Software, just like books, plays or music, can contribute directly or indirectly to society and the predominant societal benefit of viruses lies in the reaction to counteract them instead of direct contribution. I contend that software viruses deserve the same level of protection that any other creative work possesses, and arbitrarily ignoring widespread infringement threatens the foundation of copyright.

1.1.1 A History of copyright

The concept of a copyright arose in the 17th century out of a recognized lack of protection for intangible intellectual creations, as opposed to property rights for physical items. (Deazley, 2006) Society recognized the value of intellectual work as being in their expression and not its physical media. Over time, the types of protected intellectual works expanded along with their scope of protection but copyright has stayed consistent with the historical elements from which it came.

The ideals of recognition, economic rights for an author and societal interest are just as relevant in modern copyright law as they were in the first statute that embodied them. National laws evolved independently culminating in the need for international harmonization to normalize protections for native authors with foreign. By internationalizing copyright agreements, nations assured authors fair treatment for their works while simultaneously incentivizing and encouraging new works on a global scale. (WCT)

1.1.2 An evolution of copyright

Through the centuries since copyrights creation, new mediums were invented which were eventually incorporated into protection schemes, in addition to increasing the effective time for protection. Through this progression of changing laws, the founding ideals were respected as copyright expanded while the portfolio of applicable content included formats never before imagined. (Deazly, 2006)

Originally, authors disseminated their ideas through physical mechanisms such as rewriting text by hand, eventually improved by costly printing presses for mass reproduction. (Febvre, 1997) Today a few key strokes on a computer keyboard can spread essentially limitless amounts of digital material, without any consideration of the author. In this burgeoning "immediate" realm, we found a new intellectual creation that stretched authorship and intellectual property: computer software.

As courts and legislatures struggled to apply copyright to software, the nature of legal issues raised were largely of the same historical struggles encountered by books, music and movies when considered by the founding ideals of copyright: Protecting the economic and moral interests of an author while providing benefit or opportunity to society.

The need to protect authors while balancing the appetite of society is just as salient now as it was in the early 17th century. The distinction now is that the way in which society consumes information has evolved along with society's appreciation for what constitutes expression. As a result, we must be prepared to extend protection to all comers, regardless of form or potential use.

1.2 Copyright for software authors

Software presented a new dimension for copyright stemming from its identical but distinct dual forms: human-readable source code and machine-readable code.

Source code consists of the programmatic steps that make up a software program in a language or form readable by human programmers. (Doar, 2005) This source code transforms in the process of creating software, into machine-readable form that a computer can understand and run as an application. (Doar) This will be gone into more detail in Section 3 but essentially, they are two different translations of the same expression, consumable by two different audiences: people and computer but for all intents and purposes under the law, source and machine are the same. (TRIPS)

This dualistic nature of software is difficult to understand for everyday consumers who lack an understanding of the technical aspects constituting computer software, let alone what copyright is or how it applies to their daily lives. This combination of

communal ignorance of these two specialized areas, software and the law, provide new opportunity for the topic of this thesis: combining these two subjects to assert copyright infringement based on technical aspects of commercial software.

1.2.1 Applicability

Copyright protection for software virus authors is the same as with any software program. The expression of a software program, once fixed into a software-programming medium, gains copyright protection by law; fixation is required to establish the expression since an idea alone is not copyrightable. (TRIPS)

In alluding to whether the intent of software is a malicious virus or useful program, any desired objective incorporates into the programming of the software but; establishing intent relies on an actor's perpetration: an object by itself is used for an intended purpose but does not contain intent. There is no distinction included in any copyright treaty or law that delineates purpose or intent in providing copyright for software: all software has protection, without reservation as detailed in Section 4.

1.2.1.1 Nature of viruses/malware

The nature of virus software is in more detail in Section 3 but a noteworthy distinction is that viruses are executable programs. (Symantec) They can spread via several methods such as email or directly through a network and either rely on a user to initiate them or can run without user intervention or knowledge. (Symantec)

Special types of viruses reside as 'scripted' source code contained within a web page or in temporary files automatically downloaded via web browser and executed by a user's computer that translate the source code into machine code for execution, each time a person visits the website. (Wang, 2006)

1.2.1.2 Identification by prevention and removal services

Section 3 discusses the functional methods used by anti-virus software but as a generality: Anti-virus software operates by looking for activity patterns of a virus or its specific software source code. (Symantec)

To prevent an infection and remove a virus, anti-virus software companies research and compile databases of virus source code and their programmed activity patterns. (Szor, 2005) This database is copied to a user's computer via subscription so installed anti-virus software can scan for and react to viruses on a constant basis. (Symantec) In this way, companies generate revenue based on providing virus detection and removal methods derived from actual source code.

1.2.2 Removal issues with copyright

Anti-virus company infringement, as it relates to copyright, arises by the action of including virus's source code within a removal databases and subsequently distributing them, without license, recognition or payment to the author. These are commercial entities deriving an economic benefit founded on blatant disregard for the provisions of copyright.

As companies demand lawmakers to increase protection and enforcement for movies, music and books; we need to be mindful of the purity that lies behind the protection of all authors. All expression deserves protection equally under the law.

Similar to freedom of speech discussions: the worth of the thing should not bear upon the protection provided and either society respects authorship rights for all or it undermines any efforts by not.

1.3 Aspects not addressed by thesis

In order to focus this thesis on the appropriate aspects in question I will briefly address some potentially related points not included in this discussion.

1.3.1 Advocating changes to copyright laws

Instead of a criticism of existing copyright law, this thesis is a call to protect all manners of applicable creations. For viruses in particular, society should recognize that even malicious software has a positive benefit indirectly in the reaction to their potential harm. This should justify copyright protection in the minds of people who focus on the purpose of viruses instead of the holistic ideas behind copyright.

This thesis is an attempt to illustrate that copyright law needs to proceed unilaterally instead of leveraging the rights of one author (anti-virus companies) to the detriment of another (virus authors).

1.3.2 A new problem in the law

This situation is not a new problem requiring changes to copyright. The problem has plagued copyright in various forms since its inception aka what has protection versus what is actively protected. Due to nuances of software, this ever-present discussion is ripe for new consideration in a combined form of law and technology.

It is a unique problem in software that infringement of one author protects the interests of another author: pursuant to mechanism not expression. I cannot find a comparable situation where an author's own words turn into literal mechanism systematically erasing their own words, against the author's interests.

Anti-virus software is not a profoundly bad creation, quite the contrary; however, the manner of its functional execution has to reflect legal doctrines protecting authors. This thesis is a narrow consideration of specific concepts within the broader ambit of copyright issues such as fighting DVD pirating and combating music theft. ("ICE Announces Sweeping Anti-Piracy Initiative", DADVSI)

An analogous situation is the efforts by authors fighting against Google's book-scanning project, whose copyright objection to a widespread and public infringement predicates on fair treatment for copyright owners in the digital era. (Lessig, "Love of Culture, 2010")

1.4 Methodology

In conducting the research for this thesis, I considered several distinct subjects bearing few direct connections. International and national copyright laws, software in general, software design & programming methods for both viruses and anti-virus software, and criminal statutes were all researched for synthesis in this thesis.

Due to the breadth and independence of these subjects, specifically intended restraints attempt to balance all interests. Suffice to say, significantly more information lies behind each subject and section so caution dictated the depth of presentation, especially for computer-specific technicalities

1.4.1 Approach

Research began with a review of copyright in order to apply its specific interests to subsequent subjects more specifically. The criminality of viruses, as compared to other works, contained within international and national law determined the characteristic attributes of software and viruses.

These efforts sought to establish connections between copyright and criminal statutes. I found nations use criminal statutes for acts perpetrated with protected works such as cybercrime or against copyrighted works such as illegal copying but universally national criminal statutes surround copyright law effectuating established protections and not limiting expression.

Technology specifics emerged in first considering software generally then specifically through successive layers of technical detail to arrive at the nexus where commercial software practices directly infringe copyright. The nuances of software response to viruses are eerily reminiscent of legal debates over specific word interpretation in litigating a statute. In order to apply the broad ambits of copyright granularly, my restraint methods required distilling detailed technical software characteristics into more general terms.

1.4.2 Jurisdictional Constraints

Harmonized copyright recognition in international agreements extends across almost every country with few exceptions. Britain, France and the United States illustrate historical aspects of copyright since the reality is that these countries shaped the majority of copyright from inception.

While considering many national jurisdictions, international agreements generally dictate structure so they are primary for this thesis. Within, UK, EU and US cases predominantly clarify applications or interpretations where possible but in reality, for software viruses, the availability of non-criminal case law is bleak.

1.4.3 Uncertainty

There is great uncertainty in a combining copyright and software viruses before national and international tribunals in projecting their accepted definitions of specific terms or applying particular meanings. The lack of direct cases and limited legal action seeking to challenge or clarify copyright treaties provides further uncertainty for an infringement claim. As a result, for purposes of this thesis, analyzing application of legal elements to specific technical mechanisms relies upon general understandings of legislative wording to consider potential claims.

2 Copyright Protection

Copyright today is a direct descendent of its original form dating from the early 17th century. The principles established then, have guided expanding the definition of protected works as well as proscribing protection into new iterations of copyright law. (Golvan, 2007)

This section provides a historical context of the birth of copyright to instill an understanding for the underlying themes and sources for copyright: respecting the recognition of the author, protecting their economic rights and maintaining the greater interests of society. During the analysis of copyright for virus authors in Section 4, we will properly place the need for enforcement in light of the existence of protection.

2.1 Origins

Books were originally a rare commodity due to the realities of producing them. (Man, 2003) The ability to read and write was limited to those who had access to and could afford education resulting in the audience for books being a much smaller segment of society. Book publication relied on manually intensive hand copying performed by a properly educated person. Copying errors were a common problem compounded by the availability of source material. (Bischoff, 1990) Knowledge did not spread of its own accord but was easily herded by publishers and interested officials.

Governments and churches were largely able to control publishing through approving books they liked and outlawing anything considered offensive or politically subversive. (de Sola Pool, 1983) Authors were able to share their work but in very limited fashion without booksellers. As a matter of practicality, to create a copy of a book without permission required paying a person able to copy it but this entailed an added risk that the copier would create errors. (Bischoff, 1990)

With the invention of the printing press in the 14th century and the rapid spread of that technology, the ease of copying books increased dramatically. (Man, 2003) The ability to copy books on a large scale without the author's permission became an apparent disadvantage for authors who typically signed away all rights to a bookseller in attempt to generate income.

The bookseller would then proceed to print books as they chose and reaped the benefits of popular books to the financial exclusion of the author while assuming any risk of an unpopular title. Known authors become more valuable as they would more likely generate revenue; this market reality would factor into the economic rights contained in copyright to protect intellectual work from unfair appropriation. (Suarez, 2009)

Prior to the 17th century, European governments encouraged printing to sponsor education for citizens but maintained control by establishing licensing for printers. This structure allowed governments to link continued licensure to a printers' willingness to print approved books and prevent proliferation of banned books. Printers not willing to follow these conditions had their licenses revoked which meant they could not legally sell books. (de Sola Pool, 1983)

In15th and 16th century England leading up to copyright establishment, a license was an exclusive right to print a specific work for a fixed number of years. (Patterson, 1968) This license included powers bestowed by the government, on a printer, to prevent anyone else from printing the same work. It was common practice in 15th century England for merchants selling common goods other than books, to be granted an exclusive license by the King; these licenses were "monopolies" and were a framework for copyright. (Statute of Monopolies)

A London printing guild obtained a royal charter called the Stationer's Charter in 1557 that created a monopoly on book production in England. It established that once a member asserted ownership of a specific text, no one else could publish or copy it, hence the term "copyright". (Deazley, 2006)

From this auspicious environment came "An Act for the Encouragement of Learning, by vesting the Copies of Printed Books in the Authors or purchasers of such

Copies, during the Times therein mentioned" or "The Statute of Anne" in 1709: the first copyright law in England and a direct foundation for copyright today.

Its preamble sets forth:

> "Whereas printers, booksellers, and other persons have of late frequently taken the liberty of printing, reprinting, and publishing, or causing to be printed, reprinted, and published, books and other writings, without the consent of the authors or proprietors of such books and writings, to their very great detriment, and too often to the ruin of them and their families: for preventing therefore such practices for the future, and for the encouragement of learned men to compose and write useful books;" (Statute of Anne)

From its inception, copyright established the interests of the author, recognition of their economic rights balanced against society's interest in knowledge with "useful books"[1] (Deazley, 2004). The statute set forth a requirement to publish minimum amounts of a book plus pricing limitations to guarantee a printing and prevent pricing from being a tool for restricting access: these codifications were to guarantee accessibility. (Statute of Anne)

The statute created an exchange of rights between booksellers and society by giving a time-limited monopoly to print a book; previously booksellers retained a copyright in perpetuity. Once the limit of 14 years expired (21 for books already in existence), the book passed into the public domain, an idea created by the statute for the long-term interests of society and preserve the knowledge for future use. (Statute of Anne)

It is from this statute, with the recognition encapsulated within, that modern copyright takes its form. The three-legged relationship between recognition of an author, economic rights and societal improvement persists through each permutation of copyright. Any effort to increase one leg must come at the expense of the other two and as a result, copyright today retains this balance as parties whose interests would diminish naturally restrained those that increase.

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[1] "useful books" is a time period phraseology equating to interesting information

2.2 Progression

Once the 14/21 year limitation expired, English booksellers sought to extend the period of copyright to protect their dominant position. (Patterson, 1968) Copyright included a restriction on the right to print unprotected material by foreign entities. At that time, booksellers and publishers retained a books copyright in lieu of our present position in which authors retain that right. (Bainbridge 2006)

Booksellers premised their efforts on a common law argument that by establishing a statutory time limit, the government revoked a copyright unnaturally and prevented copyright holders from passing a property right to their heirs. (Patterson, 1968) Without this common law recognition, which all other property enjoyed, mandated copyright expiration harmed authorship, as economic loss would be a deterrent. Opponents to this common law claim contended it amounted to an unjust enrichment for booksellers and enabled them to control knowledge. (Deazley, 2006)

In 1769, in seeking a common law exception for copyright through the courts through a winding series of cases, booksellers finally gained a judgment in Millar v. Taylor that acknowledged a common law right preempting the Statute of Anne however, the ensuing appeal settled prior to judicial review so the issue was undetermined. (Patterson, 1968)

In 1774, the cornerstone case of Donaldson v. Beckett involving the same matter in Millar came before the House of Lords in seeking to overrule the lower court precedence of common law copyright. In opposing common law protection, the court placed the position of booksellers:

> "The arguments attempted to be maintained on the side of the Respondents, were founded on patents, privileges, Star chamber decrees, and the bye laws of the Stationers' Company; all of them the effects of the grossest tyranny and usurpation; …
>
> All societies, good or bad, arbitrary or illegal, must have some laws to regulate them [copyright]. … The manner in which the copyright was held was a kind of

> copyhold tenure, in which the owner has a title by custom only, at the will and pleasure of the lord.
>
> …
>
> Remember always that the common law right now claimed at your bar is the right of a private man to print his works for ever, independent of the crown, the company, and all mankind."

The court affirmed copyright as a granted privilege by institutions of man: not a natural right automatically granted. In effect, the right to reap financial gain under protection of law came at the price that once expired; ownership surrenders to the very society providing protection. (Donaldson v. Beckett)

Looking ahead to Section 4 and the question of whether content should effect the application of copyright; similar concern was present in this case as liberty of the press, as an argument against common law copyright, arose:

> "…a despotic minister, hearing of a pamphlet which might strike at his measures, may buy the copy, and by printing 20 copies, secure it his own, and by that means the public would be deprived of the most interesting information." (Donaldson v. Beckett)

The House of Lords summarily rejected the notion of a perpetual common law copyright and reaffirmed the Statute of Anne provision that out-of-copyright books were lawfully in the public domain. The court affirmed the need for copyright protection in closing, by stating the reality of authorship: ' Knowledge has no value or use for the solitary owner: to be enjoyed it must be communicated.' (Donaldson v. Beckett) Taken further; to facilitate knowledge, its communciation must be protected.

From its creation, copyright was reaffirmed as a legal provision to sponsor the flow of information and logically any attempt to curtail copyright based on its content obstructs this at its core. The common law debates in Donaldson v. Becket influential the future trajectory of copyright in asserting 'for the encouragement of learning, and for vesting a

right in authors' from the Statute of Anne to mean copyright is 'a creation of a property, not a further security for one.' Copyright is born of statute, provided for a limited time, in order to reward authors.

During the same period, France, another country whose development of copyright shaped our present day form was, undergoing similar transitions. As in Britain, French kings granted monopolistic licenses to printers evolving over time into a system of censorship by banning subversive books and ideas. (Ginsburg, 1990)

Beginning in 1275 and evolving over centuries in arriving in the early 1600's, French Kings, along with an increasing influence by the church, progressed from validating books for accuracy into censoring perceived attack on a person's reputation; eventually including immorality and indecency.

Compared to the British environment of the time, France was more heavy-handed in censoring works. While the British enacted the Statute of Ann, the King of France assumed the responsibility of mediating the rivaling interests of authors and publishers as plays, which along with books, become issues of concern. (Ginsburg, 1990)

While Millar and Donaldson had their day in court in England, France diverged in acknowledging inheritance rights of authors as well as limiting publisher's rights to the lifetime of the author. These decisions were short-lived as the French Revolution rocked France beginning in 1789 and continuing to 1799.

The effect of deliberate efforts to censor information by the King and church played a large role in how the country established copyright after the revolution. (Ginsburg, 1990) This is important in the future inclusion of author's moral rights into copyright, which far extended simple recognition into specific requirements and provisions.

Several disputes regarding play performances coincided with the French Government attempting to create a production monopoly for dramatic works in the state theater. The National Assembly in the early 1790s established that works whose authors died more than five years prior were public property while living authors gained the exclusive right to public performances of their works transferrable to their heirs. France considered the public domain primary and any exceptions aka copyright, should as minimal as possible so as not to detract from the public's interest. (Ginsburg, 1990)

In then further extending the right of distribution, the National Assembly based author's rights upon the Declaration of the Rights of Man and the Citizen, which acknowledged "natural rights" of an individual in society to have certain basic rights that no government can deny. (Ginsburg, 1990)

Two key items of the Declaration held:

> "The free communication of ideas and opinions is one of the most precious of the rights of man. Every citizen may, accordingly, speak, write, and print with freedom, but shall be responsible for such abuses of this freedom as shall be defined by law.
> …
> Since property is an inviolable and sacred right, no one shall be deprived thereof except where public necessity, legally determined, shall clearly demand it, and then only on condition that the owner shall have been previously and equitably indemnified."

These natural rights would be the foundation of French copyright for decades and would ultimately contribute to elements of moral rights contained in modern copyright. Moral rights are inalienable as a matter of being, existing outside copyright, which government restricts but not grants. (Macmillan, 2007) To attempt to restrict expression in limiting a fundamental protection based on its content would violate the very principle of free communication by severing natural inherency and making it societally conditional.

At the same time France and England were establishing copyright, a young country took notice and appropriated the protections for its own authors. The United States Congress enacted the "Copyright Act of 1790", borrowing heavily from its ex-colonial parent and some of the same principles shaping French law. (Ginsburg, 1990)

The need to enact protections arose due to several factors: the 1709 Statute of Anne did not apply to colonial America and there were not a lot of American authors pushing for protection prior to the American Revolution. Originally, the Continental Congress lacked authority under the Articles of Confederation to establish copyright protection and could only encourage the individual states to enact protections. (Yu, 2006)

Congress modeled the Act of 1790 the Statute of Anne in offering a term of 14 years of protection, renewable once for another 14 by living authors after which works fell into the public domain or if proper formalities were not followed. (Yu, 2006) The Act covered "the author and authors of any map, chart, book or books already printed with these United States, being a citizen or citizens thereof," and contained statutory requirements such as deposit of a copy in the clerk's office of their local district court, notification in a newspaper and proper display of the granted copyright. (Act of 1790)

In contrast to English and French acts of copyright, there was not a discussion of the common law right of protection surrounding the Act of 1790. As a result, the first US Supreme Court copyright case arrived in 1834, with Wheaton v. Peters, based partially on a common law assertion of copyright protection and a challenge to the right of Congress to enact the Act of 1790.

In denying the claim, the court addressed the common law question:

> "That a man is entitled to the fruits of his own labors must be admitted, but he can enjoy them only, except by statutory provision, under the rules of property which regulate society and which define the rights of things in general.
>
> It is clear there can be no common law of the United States. The federal government is composed of twenty-four sovereign and independent states, each of which may have its local usages, customs, and common law. There is no principle which pervades the union and has the authority of law that is not embodied in the Constitution or laws of the union. The common law could be made a part of our system by legislative adoption.
>
> …
>
> The right of an author to a perpetual copyright does not exist by the common law of Pennsylvania."

Secondly, in affirming the right of Congress to enact the copyright act, the Court asserted:

> "In the eighth section of the first article of the Constitution of the United States it is declared that Congress shall have power 'to promote the progress of science and the useful arts by securing, for a limited time, to authors and inventors the exclusive right to their respective writings and inventions.'
>
> ...
>
> Congress, by the act of 1790, instead of sanctioning an existing perpetual right in an author in his works, created the right, secured for a limited time, by the provisions of that law."

Combining the above opinion with wordings of the Act of 1790, "the author and authors of ***any*** map, chart, book or books [emphasis added]", a legal principle for virus authors under US law forms. Namely, an author is entitled to the fruits of any labor and requires legal protection to do so; hence the role of government in providing it.

Distilling this further, government has an affirmative obligation to provide protection, under which, a person can reap whatever benefit they can, for whatever labor, produced. In looking ahead to analysis in Section 4, the obligation of copyright law is to protect virus authors independently of the form of their works.

As more countries enacted varying forms of copyright, the recognized need to establish fair treatment across nations resulted in one of the first intellectual property treaties in 1883, the Paris Convention for the Protection of Industrial Property. In addition to requiring equal protection for internal and external authors, the convention sought to protect economic interests in the global market to further incentivize creative expression and enable advancement on a global scale.

Following the lead of the 1893 Paris Convention another convention was convened in Berne, Switzerland resulting in a harmonization treaty intended to normalize copyright treatment in recognizing that copyright for creative works is automatically in force once it was been fixed in a physical medium. This was to do away with the burden of having to register for a copyright in each country as well as giving foreign authors the same rights as

domestic authors in any country that signed on to the treaty (Art. 5). Fixation is now the only affirmative responsibility an author must take to establish copyright.

The treaty embodied authors moral rights found in France's copyright law into Article 6*bis* and set them independent of any economic rights regardless even if they are transferred; such as the right of recognition or distortion of their work. Implicit to these moral rights is the understanding that for the duration of the protection period, an author can choose to share or restrict access to their work; a right that ends once the work passes into the public domain. (Art. 9)

Further, it is difficult to interpret rights respecting an author's decision to publish or withdraw for only things tacitly approved by society: content of the expression is not a matter of condition for any of these rights. At every opportunity at which copyright expanded or was attributed new responsibilities, there was not a provision incorporated to tie the protection to content.

2.3 What is copyright today

This thesis will not address the progression from history into modern conventions, as the purpose was to illustrate the principles that created copyright. Their evolution expanded into other expressions and other countries that mirrored the above progressions; while important, for the purposes of this discussion, that evolution is not applicable.

Copyright protection today is enshrined predominantly in international treaties with national laws enacted to comport with the provisions found in these treaties. We will briefly review the main international agreements in their current form, to consider how far copyright has come from its roots in English bookselling and to establish a base for later analysis.

2.3.1 Berne Convention for the Protection of Literary and Artistic Works

First accepted in Berne, Switzerland in 1886, these provisions have several amendments with the last being in 1979. The convention established a common foundation for what works are protected, the term of protection, requiring fair treatment across signing

countries as well as provisions for seizure of infringing works and the reservation of potential member nation legislative exceptions.

The works protected are many with Article 2 of the convention defining literary and artistic works as including:

> "every production in the literary, scientific and artistic domain, whatever may be the mode or form of its expression…"

In Article 5, the convention established a system of national treatment where foreign authors are to be treated the same as domestic authors. It also prohibited formality requirements (registration) so that copyright applied simultaneously in all signing countries upon publishing in their home country.

Under Article 7, countries can grant protection terms longer than the stated minimums but must then extend those protections for foreign authors as well as domestic.

Notable for discussion in Section 4, in balancing the interests of society in furtherance of the work, Article 10 establishes a fair use provision making it "… permissible to make quotations from a work which has already been lawfully made available to the public". The effect of this is to enable use of copyright works in publications or broadcasts that are intending to notify the public of the work or acknowledge it as a source but for informational purposes only.

The Convention does contain a provision for member countries allowing them ability to exercise legislative or regulatory censorship without violating the agreement. Article 17 sets forth:

> "The provisions of this Convention cannot in any way affect the right of the Government of each country of the Union to permit, to control, or to prohibit by legislation or regulation, the circulation, presentation, or exhibition of any work or production in regard to which the competent authority may find it necessary to exercise that right."

This is not a reservation to providing copyright protection but allows a country to prevent display or circulation of works; it does not remove the rights of an author to their work.

Lastly, the Berne convention provides the "Berne three-step test" for consideration when a member country attempts to limit or enact an exception to exclusive authorship rights in their national copyright laws. Article 9(2) provides the effective test as:

> "It shall be a matter for legislation in the countries of the Union to permit the reproduction of such works in certain special cases, provided that such reproduction does not conflict with a normal exploitation of the work and does not unreasonably prejudice the legitimate interests of the author." [3 step test underlined]

2.3.2 World Intellectual Property Organization (WIPO) Copyright Treaty

Adopted in Geneva at the end of 1996, the Treaty extended copyright protection for the realm of information technology arising since the enactment of the Berne convention. As Article 1(1) sets forth:

> "This Treaty is a special agreement within the meaning of Article 20 of the Berne Convention for the Protection of Literary and Artistic Works, as regards Contracting Parties that are countries of the Union established by that Convention. This Treaty shall not have any connection with treaties other than the Berne Convention, nor shall it prejudice any rights and obligations under any other treaties."

Similar to the Berne Convention, the Treaty establishes Rights of Distribution, Rental, and Communication to the Public for computer programs and compilations of data (databases).

Per Article 4 (Computer Programs):

> "Computer programs are protected as literary works within the meaning of Article 2 of the Berne Convention. Such protection applies to computer programs, whatever may be the mode or form of their expression."

And Article 5 (Compilations of Data)

> "Compilations of data or other material, in any form, which by reason of the selection or arrangement of their contents constitute intellectual creations, are protected as such. This protection does not extend to the data or the material itself and is without prejudice to any copyright subsisting in the data or material contained in the compilation."

Contained with the Treaty is the three step test set forth in the Berne convention (Art. 10) as well as an obligation to enact legal remedies for circumvention of technological measures used to protect copyright (Art. 11) as well as remedies for alteration or removal of electronic rights management information (Art. 12).

2.3.3 Agreement on Trade Related Aspects of Intellectual Property Rights (TRIPs)

> "The World Trade Organization (WTO) is the only global international organization dealing with the rules of trade between nations. At its heart are the WTO agreements, negotiated and signed by the bulk of the world's trading nations and ratified in their parliaments. The goal is to help producers of goods and services, exporters, and importers conduct their business." (WTO)

TRIPs is a trade organization agreement introducing intellectual property law into international trading systems and negotiated in 1994. Membership in the WTO carries with it mandatory agreement to TRIPs so consequently countries that may not sign the Berne Convention would become signers in order to gain trade access to member countries.

Many provisions in this agreement are imported from the Berne Convention (TRIPs Art. 9(1)) incorporating aspects outlined previously such as no formality requirements (Art. 9(2)), term of protection (Art. 12), national treatment (Art. 3), equitable procedures for remedy, (Art. 42) and fair use.

Notably, TRIPs explicitly recognizes computer programs and databases in Article 10:

> "1. Computer programs, whether in source or object code, shall be protected as literary works under the Berne Convention (1971).
> 2. Compilations of data or other material, whether in machine readable or other form, which by reason of the selection or arrangement of their contents constitute intellectual creations shall be protected as such. Such protection, which shall not extend to the data or material itself, shall be without prejudice to any copyright subsisting in the data or material itself."

TRIPs also incorporates the Berne 3 step test in Article 13.

While not an overly exhaustive accounting of every adjustment and change to copyright law from its origins in 1709, the historical origination and progression of copyright should illustrate the intent for both authors and society. The acknowledgement and legal enshrinement of authorship rights across this diverse group of ethnic, social and political groups is a measure of the esteem to which society holds copyright and the importance of consistently and fairly upholding it.

3 Related Technology

3.1 Introduction

Before continuing forward in analyzing software viruses within copyright, we will review some basic technological explanations. The intent of this section is not to delve deeply into all the nuances of software, viruses and removal applications but instead to give the reader a basic level of understanding regarding all three; it is not exhaustive and there will be areas of each kept outside of this thesis.

We will begin with software in general to provide a context in which to understand how software works, some key distinctions that will bear later in the review of viruses, and finally to understand the dual nature of software: both as source code and executable program. (Prata, 2004) Following the review of software review is an explanation of viruses in order to place their characteristics and activities within the greater context of software. Lastly, the focus will shift to anti-virus software from a mechanical point of view in how it detects, prevents and removes virus infections.

Once this section has laid the technological foundation, Section 4 addresses how copyright applies to authors of viruses and their works in addition to potential infringement claims and causes of action.

3.2 Computer Software

There are several variations of the definition of software, depending on the context, and while technical journals provide a more in-depth definition better suited for computer programmers; we will begin with a more simplistic version.

> "Instructions that tell a computer what to do. Software comprises the entire set of programs, procedures, and routines associated with the operation of a computer system. The term was coined to differentiate these instructions from hardware—i.e., the physical components of a computer system. A set of instructions that directs a computer's hardware to perform a task is called a program, or software program." (Encyclopedia Britannica)

For this discussion, we will discuss system software, which is the platform of a computer, application software that are the programs users run, and programming software from where software is created via source code.

3.2.1 System Software

System software generally, is the various software components that together, allow a computer to operate. (Encyclopedia Britannica) The main example of this type is operating systems; such as Microsoft Windows, Mac OS X, and Linux. Within each one of these operating systems are smaller, compartmentalized pieces of software that allow the operating system to control the hardware on which it resides. Device drivers are a common example of these compartmental pieces that a typical computer user would likely be aware. (Parsons, 2009)

Device drivers are software components written for a specific operating system such as Windows or Mac, through which that operating system "talks" to hardware components of a computer, such as a keyboard for input, a central processor for executing commands or a monitor for displaying output. (Parsons, 2009) Without drivers, an operating system does not know what a piece of hardware is or how it can use it.

For the purposes of this thesis, consider the operating system to be the primary area of concern and just know that underneath it, lies device drivers working to interface with actual physical hardware components. Operating systems as well as things like device drivers can contain errors which viruses can take advantage of to infect a computer.

3.2.2 Application Software

Application software consists of the programs users install on a computer in order to use it for various tasks; common examples would be Microsoft Office, Adobe Reader, Internet Browsers, iTunes etc. Application software or applications are written for specific operating systems and typically require an installation process via a CD/DVD or download from the internet. (Encyclopedia Britannica)

For just about every activity computers are used for is accomplished by using application software installed on an operating system. Application software cannot function without an operating system as any required interaction with a keyboard or display by an application routes through the operating system. (Parsons, 2009)

The installation process for applications places various files on the operating system that it will need in order to function. The process of installing a program is largely just copying files to specific locations in the operating system along with any configuration settings, which tell the operating system what the program does and what resources (hardware or other software) it will utilize to function. (Henderson, 2008)

These copied files are specially created software components that a software company makes in the process of creating an application: they are the building blocks that make up the application itself. (Parsons, 2009) In jumping ahead briefly, these building blocks are where programming errors or software holes also exist which viruses exploit.

There are some types of applications, which do not require an installation process and function immediately once accessed or executed. These applications function by relying on operating system software components or building blocks instead of unique components created by a software author and copied during an install process. (Liberty, 2005) Most applications bring new functionality to a computer and require additional building blocks while existing functions on an operating system are designed only for built-in functionality.

Within the context of viruses, it is advantageous to program them to use the existing building blocks on a computer in order to reduce size, speed transmission and immediately function without any installation or interaction by a user.

3.2.3 Programming Software

The last type of software is programming software. This unique category of software creates all the software applications associated with computers; they are the virtual workshops used to create software and are referred to as programming environments.

Programming software is actually a type of application software since it utilized after installation on an operating system; some examples would be Java, C++, and Visual Basic. (Liberty, 2005) These programming environments are where programmers write *source code*, which turns into *executable code* through use of a *compiler*. (Jones 2004) These programming terms, require further definition to establish a basic level of understanding for their use in later discussions.

3.3 Software Development

3.3.1 Source Code

The base form of software is source code. Source code is human readable instructions that make up all the commands and functions of software. (Jones, 2004) A programmer uses a programming language in order to write these commands similar to using a foreign language to communicate. Source code consists of many lines of commands that would not make much sense to an average person reading them.[2]

Applications can be comprised of hundreds of thousands if not millions of lines of source code depending on the application complexity, which would be unmanageable to try to run as human readable source code. This complexity contributes to programming errors that some viruses exploit.

---

[2] Example of source code that pops up a message that says Hello World (Flanagan, 1996)

```
public class FirstApplet extends Applet {
public void paint(Graphics g) {g.drawString("Hello World", 25, 50);}}
```

In contrast, machine languages are exponentially faster since it is a computer's native language and structured far more efficiently. (Jones, 2004) Think of an article in a newspaper with all its formatting and explanations for various levels of readers; machine code would be comparable to removing all the formatting along with any extraneous explanation and simply be the facts without grammar, illustration or explanation.

Source code is readable by humans however; computers do not understand our language and instead understand their machine language or executable code. (Jones, 2004) This machine language is "the numeric codes for the operations that a particular computer can execute directly" and is "… difficult to read and write, since it does not resemble conventional mathematical notation or human language, and its codes vary from computer to computer." (Encyclopedia Britannica) Consider executable code a translated version of source code that in essence is a secondary form of those original instructions.

The distinction is important to understand because copyright deals with the expression of an idea and both the source code and executable code are protected as the same expression, since they are in essence two forms of the same idea. (TRIPS Art.10, WCT Art.4)

3.3.2 Compiled Executable Code

In order to translate source code into executable code, a compiler is utilized. A compiler is "Computer software that translates (compiles) source code written in a high-level language (e.g., C++ {human readable}) into a set of machine-language instructions that can be understood by a digital computer's CPU. Compilers are very large programs, with error-checking and other abilities." (Encyclopedia Britannica) The process of compiling software is what creates the customized files copied to a computer during installation of an application.

Commercial applications, such as iTunes or Microsoft Word, are compiled prior to distribution for sale. However, an exception to this compile-once-then-distribute paradigm exists in how websites function. The source code of a web site is in human readable source code, compiled by both the web server it resides on and a user's web browser each time the

website is accessed as opposed to applications that are compiled for installation. (Flanagan, 2006)

This distinction is important: the software downloads as source code and is compiled, then executed by a user's web browser.

This relationship is deliberate so that when there are thousands of people accessing a website, it does not slowdown in response to running many requests for the same software application. (Flanagan, 2006) Using a user's computer to execute the code shifts computer processing to the user's computer and is a trick that contributes to website responsiveness under times of high usage. This is something to consider for later discussion since users are essentially downloading source code to their local computers and is the trigger anti-virus software uses to detect and remove viruses. (Skoudis, 2003)

A term that may be familiar is "scripting" which is what that method of deploying source code via websites is called. (Flanagan, 2006) It is used to different from compiled applications because the end users computer and web browser is "scripted" to behave in a certain way in order for the web content to function properly for things such as formatting and website functionality. (Flanagan, 2006)

3.4 Viruses and their Removal

3.4.1 Overview

Computer virus defined is "A program that is designed to spread from computer to computer on its own, potentially damaging the system software by corrupting or erasing data, using available memory, or by annoying the user by altering data. A virus is designed to replicate. Generally, it is spread by infecting other files." (Encyclopedia Britannica)

"Virus" is used generically in this thesis to represent all types of programs that infect and cause harm to computers. There are several types of viruses that are defined by specific characteristics, which differentiate themselves at a technical level as to how they are built and on an operational level in how they functionally operate. The result is the same for a computer user: data is corrupted or lost, personal information stolen or operating systems and applications rendered useless.

Regardless of the specific type of virus, in relation to the question of copyright, all types of viruses are software programs.

3.4.2 Software Viruses

Per the above definition, viruses are designed to replicate by attaching to executable programs such as Microsoft Word or iTunes. When that executable program activates, this initiates the virus to infect other executable files as well as any other actions programmed to perform such as deleting files. These secondary actions beyond replicating are a virus's "payload".[3] A virus requires user action in order to activate itself, typically through executing an infected file received via email or portable media such as a USB drive, floppy disk or CD.

A virus attaches to an executable program by adding its software code to that programs files or even replacing a specific file(s) altogether used by that application. These lines of source code are how viruses are detected on, a computer and what are 'cleaned' by anti-virus software, discussed in the next section. (Grimes, 2001)

Malware is a common term used in discussing software viruses. It is defined as "short for malicious software and is typically used as a catch-all term to refer to any software designed to cause damage to a single computer, server, or computer network, whether it's a virus, spyware, et al." The term is used interchangeably with 'virus' however the distinction lost by most is unlike a virus, malware can actively transmit itself over a network to find other computers to infect without any direct action by a user. (Grimes, 2001)

These types of programs use actions such as operating a user's email application, such as Outlook or Eudora, without notifying the user or by accessing a network connection directly and scanning other computers on the network for known security holes and exploiting them to gain entry where the process starts anew.

A reality of software is that all operating systems contain programming holes or "bugs" which are "a flaw, mistake, or fault in a computer program that produces an

[3] the portion of virus code that executes a mmischievous or malignant act – Skoudis, 2003

unexpected result, or causes the program to behave in an unintended way." (Encyclopedia Britannica) Computer companies constantly fix problems in their systems and update users systems to prevent exploitation by viruses, system errors and crashes (Liston, 2005). Malware programming looks for specific unfixed holes and since these flaws operate in specific ways, programmatic steps can take advantage. (Skoudis, 2003)

To put this in understandable terms, by analogy think of an ideal house with a front door that has a lock on it. An analogous error in this scenario would be that instead of putting a keyed lock on that door, the house builder mistakenly installed a doorknob that did not have a lock, allowing anyone to open the door. This situation happens in the software world where designs are misinterpreted or incomplete resulting in potentially predictable problems.

In relation to the house example, it would follow that every house that has this problem has a red door, whereas a fixed house has a blue door. Malware looks for an equivalent indicator of an unfixed, exploitable condition and "walks" through the unlocked door to wreak havoc within the computer system.

This is a simplistic explanation; however, the technical aspects as to how this process works are far beyond the needs of this thesis. Suffice to say, there are open doors inadvertently programmed into operating systems, device drivers, and applications exploited by malware authors to gain entry to a computer. The software code as well as this scanning activity is what triggers anti-virus software to prevent and intercept malware from accomplishing its programmed mission.

3.5 Anti-Virus Software

3.5.1 Overview

Anti-virus software is "Software and technology that is used to detect malicious computer applications, prevent them from infecting a system, and clean files or applications that are infected with computer viruses." This software is a commercial

product and includes a subscription to a service that updates a localized database (stored on the user's computer) used to identify viruses and remove them. (Grimes, 2001)

Typically, this subscription is limited by requiring payment in order to provide a user with up to date information, due to the reality that new viruses are created every day. (Symantec) Examples of companies that produce anti-virus software are Symantec, McAfee, AVG, F-Secure and Trend Micro. Some companies provide free subscriptions to their virus database, such as AVG, however this is more the exception to a general method of how companies that produce this software do business. (AVG, McAfee, F-Secure, Symantec)

These companies essentially function on a two-fold basis. The first is creating and improving the anti-virus software in order to protect new operating systems as well as new methods to detect and remove viruses. Virus writers continue to evolve how viruses operate and today's versions are far more advanced than the first ones to appear. (Malin, 2008) This progression requires these companies to innovate their products in order to prevent viruses from being able to circumvent them.

The second area in which anti-virus companies operate is finding and dissecting new viruses as they appear in order to produce the programmatic steps to remove them upon which their products operate. (Symantec) As viruses are released into the wild the faster a company can update their software, they better they can protect the people paying for their services. [4]

These companies constantly search for new viruses, acquire a copy and analyze the software code itself in order to understand how it works, which files it infects, and what its ultimate intention is. Based on this analysis, detection and removal methods are incorporated into subscription files. (Symantec) These subscription files, referred to as definition files, are available to end users who have an active (paid) subscription for their product.

[4] "in the wild" phrase used to indicate a malicious program is widespread and routinely reported to virus researchers (Grimes, 2001)

3.5.2 How they work

Anti-virus software functions to identify viruses based on two primary methods: signature-based and heuristics. The software uses pre-programmed methods to prevent infection and remove a virus if infection has already occurred such as in the case of file attachment in an email or a file copied from a USB memory stick or the internet. This is important in order to understand how anti-virus software techniques execute in absence of copyright.

Signature-based[5] detection relies on matching the contents of a potentially infected file to a dictionary of viruses contained within the local database, updated by subscription as noted above. Generally, every anti-virus company uses this method.

Potentially infected files are scanned based on the characteristics of the file (type of file or even size) as well as the nature of viruses that could infect it. Some viruses only infect executable files (with a .exe file extension) or only Microsoft Word or Excel files; so in order to be efficient, anti-virus software would only scan for potential viruses that could infect that type of file, ignoring any others which are not applicable.

The file is checked for specific characteristics of each potential virus to determine if an infection has occurred by looking for identifying pieces of that virus in the file itself. (Skoudis 2003) This information is what is included in the virus database, along with researched steps to remove the virus code and prevent it from activating when the file is eventually used. The takeaway from this method is that the actual code of the virus is critical to detect the presence of a virus.

Heuristics, in general terms, is finding an answer "by using or obtained by exploration of possibilities rather than by following set rules". In computing terms, heuristics is further defined "denoting a rule of thumb for solving a problem without the exhaustive application of a set of rules for solving a problem in a finite number of steps." (Encyclopedia Britannic)

What this means to non-technical people is when determining whether a virus is present in a file, its software code is analyzed based on what its intended behavior is

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[5] Signature is "The binary pattern of the machine code of a particular virus." (pcmag)

programmed to. A detection of a virus would be triggered if regardless of specific steps in the file's code, the outcome is consistent with a known virus. (Liston 2005) This is a computerized version of the old saying "if it smells like a rose and looks like a rose, it must be a rose"

This behavior-based method is in response to new methods of programming viruses to change their own software code upon successful infection or before they copy themselves to another computer prior to a subsequent infection. This adaptive method is a higher form of sophistication by virus writers using polymorphic[6] coding methods. For the signature based approach above, specific lines of code are literally searched for which would not be successful for an adaptive virus however its intended behavior would be similar.

As an example in the real world, if you have ever asked a group of people directions to get from one place to another, you likely have gotten more versions than there are people asked. Several answers may be correct though a disagreement will likely arise over which is faster or shorter. In a computer virus, and being very simplistic, an author could deliberately program variations into their programs that get to the same result but can follow different steps, some of which are less efficient than the expected method.

Put in a computing context, if a virus what infects a Microsoft Word document attempts to open an internet browser, regardless of the steps used, anti-virus software would detect this abnormal behavior and is heuristically programmed to know this is not a normal operation. Anti-virus software would use the attempted activity to search for a known viral activity contained in its database in order to take corrective steps. The corrective steps for a signature-based detection can be different from a heuristics based detection since the virus's software code could be significantly different.

The one drawback to this adaptive method of scanning is false positives are potentially generated. This occurs when a program is validly executing an abnormal command not due to a virus but still triggers detection by an anti-virus program. This has

[6] Polymorphic programs change their appearance each time they run by scrambling their code (Skoudis 2005)

created problems for users by having files deleted or changed that should not have been and has resulted in some widespread embarrassments for anti-virus companies (Symantec)

3.5.3 Virus Databases

The final aspect as to how anti-virus programs are able to function and the primary issue in regards to copyright infringement for virus authors is the signature database upon which the software depends to identify and remove viruses. This signature file resides locally on a user's computer and is updated regularly by anti-virus companies to increase detection abilities. The average number of viruses identified within this signature file is over 649,951 and will continue to grow in number. (McAfee-vil)

In terms of a virus database, a signature is "a search pattern—often a simple string of characters or bytes—expected to be found in every instance of a particular virus. Usually, different viruses have different signatures". In essence, it is actual lines of software code from a virus in order to identify it and to a degree large enough to detect the originating virus. (Symantec, McAfee-vil)

Anti-Virus companies do not indicate how much software code is included in this signature but it would need to be enough to encapsulate any variation since removal methods vary. Simple viruses can consist of a few lines of source code whereas a more sophisticated virus could contain hundreds or thousands of lines. (Skoudis, 2003)

From a magnitude of scale, for a simple virus a line or two of source code would be its majority and complex viruses would require enough lines of source code to cover unique functions specific to that virus equating to significant amounts of actual source code in order to identify it properly. (Symantec, McAfee) This inclusion is the lynchpin of potential infringement.

The basic design reason for this repository, a localized copy of a virus library from its respective company, is for speed of detection and a matter of practicality for when a computer does not have access to the internet to communicate with the company library. (Grimes, 2001) Keeping it local allows software to utilize local computer resources instead of sending an unending stream of data by millions of users to a central repository located at a company. Under a centralized design, if a person inserts a disc or USB drive while

disconnected from the internet, an infection could occur and with damage done before the computer may be able to access a centralized location if it is able to at all.

Virus database files are proprietary to each company that produces them and protected from public scrutiny. This is a business reality designed to prevent third parties from undercutting their subscription costs as well as deriving an income stream to continue to fund operations relating to analysis of new viruses. It also prevents another anti-virus company or even virus authors from reverse engineering how their software operates to either copy specific functionality or write viruses to circumvent it entirely.

The fundamental issues with the lack of communication to authors in terms of minimum requirements of notification to, or permission from, virus authors coupled with how the amount of protected source code incorporated into commercial products potentially in an adverse fashion to the economic interests of the author produce problems in relation to inherent copyright.

4 Infringement or Excusable Activity?

4.1 Are viruses protected works

To assert copyright infringement, viruses must be established as a protected work under copyright law. Regardless of their programmed intent, viruses need recognition in their expressed form of software before considering exceptions to this grant of protection by government or the merits of doing so.

National and international copyright laws rely upon various definitions in attempting to define what constitutes a software program. The Berne Convention, as a controlling international agreement for copyright, does not contain a definition for software at all. In drafting the WIPO Copyright Treaty, the drafters considered the definition of "computer program" adopted under the WIPO Model Provision on the Protection of Computer Programs to provide a valid definition. Computer programs are:

> "a set of instructions capable, when incorporated in a machine-readable medium, of causing a machine having information-processing capabilities to indicate, perform or achieve a particular function, task or result"

Section 101 of the U.S. Copyright Act (17 U.S.C.) defines "computer program" as:

> "a set of statements or instructions to be used directly or indirectly in a computer in order to bring about a certain result".

The Council Directive 91/250/EEC of May 1991defines computer program as:

> "Whereas, for the purpose of this Directive, the term 'computer program` shall include programs in any form, including those which are incorporated into hardware; whereas this term also includes preparatory design work leading to the development of a computer program provided that the nature of the preparatory work is such that a computer program can result from it at a later stage"

Clearly, software viruses by expression and definition fall into the greater context of computer programs. Per the previous sections discussion combined with the above definitions; software viruses are comprised of set of programmed steps or statements arranged to bring about specific outcomes by a computer.

None of these definitions requires a specific programming language, exclude any expressed forms, dictate a programming method or speak to any specific outcomes of the program. Whether a piece of software is as complex as an operating system, as specific as a device driver or as malicious as a virus: they all qualify under these definitions.

4.2 What Activity is Grounds for Infringement

The research of viruses to isolate, identify and create a cleansing method may infringe an author's rights however; there are exceptions. An infringement claim for this research turns on whether it is for purely educational reasons or is pursuant to commercial ends and compounded by potentially requiring explicit permission from an author. The research process itself may fall under the definition of reverse engineering which provides a separate avenue for an infringement claim. [7]

Anti-virus software, by including a database with copies of virus software code, provides the main incidence of infringement in both scale and activity. Through company's own admission, the amount of a virus's code constituting its signature is enough

[7] "Reverse engineering is the process of starting with a finished product and working backwards to analyze how the product operates or how it was made." Secure Serv. Tech., Inc. v. Time & Space Processing, Inc., 722 F. Supp. 1354 (E.D. Va. 1989)

to identify it across any variations and is a bit by bit copy[8]. Unlike the indirect heuristic approach for behavioral detection, a signature-based method requires comparing potentially infected files against identifiable pieces of virus source code.

Surrounding these specific areas is the matter of moral rights, which may not directly prohibit use of a work if the author is unknown but do require recognition and potentially fair compensation; especially if an author has the right of economic opportunity reserved.

A virus author could introduce a virus to prove the existence of a security hole, which is unbeknownst to its author, in an attempt to generate revenue. There are companies and security focused groups that do this exact thing, some looking for compensation and others to further standards of secure computing for the industry; both establish the economic value of producing similarly exploitive software as viruses in order to sell a software fix or provide consulting services. (White Hat)

In this regard, a virus writer could readily assert a societal benefit from their activity in making software more secure and encouraging better programming practices instead of being perceived as malicious or criminals.

4.3 What Rights Exist For Authors

We will consider each basis of claim in relation to the possible protections granted by treaty and national laws, which may contain potential excuses to protecting virus authors. The purpose will be to demonstrate a valid basis for a claim of infringement and address the potential exclusions anti-virus companies could rely upon in defense.

4.3.1 Reproduction Right

Article 9 of the Berne Convention provides that:

[8] Bit - A bit is a single binary digit (Grimes, 2001)

> (1) Authors of literary and artistic works protected by this Convention shall have the exclusive right of authorizing the reproduction of these works, in any manner or form.

This exclusive right allows the author of a virus to object to a reproduction of their work in any manner or form. The use of source code within a signature database is a matter of reproduction under "any manner or form" since the signature relies on a specific copies of identifiable elements of their work.

It would be fundamentally difficult to counter that the copy and inclusion process does not relate to a specific work as the principle behind it, is for anti-virus software to identify the originating source code precisely. This premise is self-defeating in that to claim the comparing code pieces are generic or non-specific therefore not from a specific virus: how would anti-virus then proceed to detect the specific virus?

For an exception to this reproduction right to exist thereby allowing reproduction without permission, an individual nation would need to enact legislation. To craft a successful exclusion, the national law must satisfy all the steps found in the subsequent sub-section of Article 9, commonly referred to as the Berne 3-Step Test, which states:

> (2) It shall be a matter for legislation in the countries of the Union to permit the reproduction of such works in certain special cases, provided that such reproduction does not conflict with a normal exploitation of the work and does not unreasonably prejudice the legitimate interests of the author.

The last "step" regarding the legitimate interest of the author, is a very high hurdle to overcome in order for an exception to reproductive rights to exist. The phrase "legitimate interests" is not defined in the international agreements that affirm this test and this ambiguity led a panel, organized by WIPO, to consider its meaning.

The Panel report held:

> "The overall conclusion of the TRIPS Panel about the third step of the test is that prejudice to the legitimate interests of right holders reaches an unreasonable level if an exception causes, or has the potential to cause, an unreasonable loss of income to the right holder." (WIPO - SCCR/9/7)

It went on to emphasize that in judging the degree of unreasonableness contained in an exception, potential rather than actual are more relevant. These phrases, as well as the panel opinion, have not been directly challenged in an international court so how well this assertion comports is unclear.

Suffice to say, legitimate interests of an author are their economic opportunity derived from their work. These can also include moral rights based on recognition, objective and permission of publication for their works; addressed in the following section. (WT/DS160)

In effect, in order to restrict copyright for virus authors, a national legislation would need to satisfy restricting an authors' right to reproduce their source code for their economic interests while simultaneously allowing a commercialized company to gain economic benefit.

That potential paradox is reminiscent of the historical battle by booksellers to claim an economic right to publish a book based on their economic interests while ignoring an author's interests. As you recall from section 2, that attempt failed and nothing has changed in copyright since the Statute of Anne that would allow it to survive in present day.

For virus authors, the right to object to this reproduction would rely on establishing that including parts of their source code in a virus database is sufficient under "any manner or form". Once that is accomplished, the only defense would lie in national legislation, which has to survive a challenge based on "legitimate interests of an author".

4.3.2 Publication

Under Article 8 of the WIPO Copyright Treaty, the Right of Communication to the Public contains that:

> "Without prejudice to the provisions of Articles 11(1)(ii), 11bis(1)(i) and (ii), 11ter(1)(ii), 14(1)(ii) and 14bis(1) of the Berne Convention, authors of literary and artistic works shall enjoy the exclusive right of authorizing any communication to the public of their works, by wire or wireless mean, including the making available to the public of their works in such a way that members of the public may access these works from a place and at a time individually chosen by them."

Within the discussion of this thesis, the author of a virus would retain the right to authorize ***any*** communication to the public of their works. The use of source code in a signature database could constitute a communication under Article 8 as it does not explicitly state in what form this must take.

In consideration of the stated inclusion in Article 8, use of a virus author's work in a signature database, pursuant to an ability to remove viruses, could constitute "accessing the work" even if it is through anti-virus software.

The reality is that clarification as to what "authorizing any communication" readily means is not firmly established. For a virus author, does programming into a virus the ability to self-copy constitute the authorization of communication or would it require an author to affirmatively publish source code?

A virus author could assert that an executable program is not the same as source code in terms of human readability and does not constitute a communication of the source code but instead the communication of an action. Communication, by one definition, is the sending or transmission of information; however, another definition is "something imparted, interchanged or transmitted". (Encyclopedia Britannica)

The distinctions of "communication" in Article 8 remain unsettled as debates continue as to where communication occurs, when it occurs and who is actually making the communication in our modern digital environment. The debate relating to communication, lie far beyond this thesis but suffice to say, the intricacies of software and its source versus executable nature as well as whether being programmed to do something constitutes an expression of an author's right, provide justiciable grounds for a claim of infringement.

4.3.3 Distribution

An exclusive right for an author regarding the authorization of distribution resides in the WIPO Copyright Treaty Article 6(1) that states:

> "(1) Authors of literary and artistic works shall enjoy the exclusive right of authorizing the making available to the public of the original and copies of their works through sale or other transfer of ownership."

In the context of anti-virus software, this may be grounds to assert that an author retains the exclusive right to authorize the inclusion of their software code in the signature database utilized by anti-virus software.

Considering that commercial entities are deriving an economic gain from this inclusion, "sale or other transfer of ownership" without permission, would infringe on the exclusive economic interests of an author. These companies would need to demonstrate that incorporating source code into proprietary databases does not constitute "making available" and this action does not interfere with that right of an author.

However, economic factors are contained in this Article, which would further require a showing that virus authors remain free to sell or transfer ownership of their works. The fundamental problem is that by including source code in their product, the potential market for sale of that source code is effectively extinguished. The market that would consume the source code is already taking it for its own use and no opportunity for sale or transfer would realistically exist.

Under this Article, virus authors would be entitled to a consideration of their economic interests in relation to the diminishment of the market and the ensuing devaluation of their works taken for use instead by licensing or sale.

4.3.4 Alteration

Under the Berne Convention Article 12, the Right of Adaptation, Arrangement and Other Alteration hold that:

> "Authors of literary or artistic works shall enjoy the exclusive right of authorizing adaptations, arrangements and other alterations of their works."

The implications in regards to the research and distillation of their source code to be included in a commercial product could be an infringement of this right. While adaptation originally corresponded to literary efforts such as adapting a book into a play, a form of the definition of adaptation is "Something, such as a device or mechanism, that is changed or changes so as to become suitable to a new or special application or situation." (Merriam-Webster)

In the current discussion, an author could contend that taking the source code of their protected work and adapting it into use as a way to identify, for removal, instances of that source code is of a nature to which they should have the right to object. Similar to conventional understanding relating to preventing a corruption or serious alteration of a book recast into a play, this transmutation of source code in form and use, is a similarly potential egregious act for a software author and the right of objection applies.

4.3.5 Protection of Technological Measures

Article 11 of the WIPO Copyright Treaty, Obligations concerning Technological Measures, holds:

> "Contracting Parties shall provide adequate legal protection and effective legal remedies against the circumvention of effective technological measures that are used by authors in connection with the exercise of their rights under this Treaty or the Berne Convention and that restrict acts, in respect of their works, which are not authorized by the authors concerned or permitted by law."

While this may seem better directed towards preventing DVD encryption, some viruses contain encryption designed to prevent detection or adaptive programming steps to allow viruses to change their code form from one computer to the next (described in Section 3).

In the course of researching a virus, anti-virus companies likely circumvent these technological measures to one gain access to the source code. This research contributes to creating circumvention methods for their removal software.

A detached review would consider in what way is this different from cracking DVD encryption and building them into a distributable program; an activity that has been found to breach copyright and criminal statutes the world over. The outcome in terms of an encrypted virus is effectively the same: the protection is broken in order to affect the source material. (DMCA, EUCD)

4.3.6 Reverse Engineering

In our context, the disassembly of a virus, potentially encrypted, is problematic for anti-virus software companies, in that the nature of the reverse is key to whether it is allowed for a copyrighted work.

Under TRIPS, Article 10.1, countries can create national exceptions to copyright for specific cases that do not conflict with normal exploitation of the work. Two examples of this are the Digital Millennium Copyright Act (DMCA) in the US and Directive 2009/24/EC on the legal protection of computer programs in the EU.

§ 117(a)(1) of the DCMA allow for copies of software “as an essential step in the utilization of the computer program in conjunction with a machine and that it is used in no other manner, or “ or what is termed as interoperability.

Article 5(3) of Dir 2009/24/EC provides an exception, which does not require authorization by a software author, “to observe, study or test the function of a program to determine the ideas and principles which under lie the program”.

Additionally under Article (6), authorization by a rightholder is not needed for reverse engineering related to the interoperability of software with other software specifically.

The problem with both of these for the usage by anti-virus companies is that the DCMA reserves its exception for a licensed user of the original software. Likewise EU Dir 2009/24/EC specifically includes "a right to use a copy of a computer program" in Article 5 and further in Article 6(1), (a) "by the licensee or person having a right to use a copy of the program", (c) "confined to the parts of the original program which are necessary for… interoperability".

Even more damning for anti-virus companies under Dir 2009/24/EC, is further in Article 6(2), the exclusions outline are explicitly not permitted for "goals other than to achieve interoperability" (2)(a), "to be given to others… except for interoperability" (2)(b), and "or any other act which infringes copyright" (2)(c).

In contrast to the above discussions regarding distributed or production rights, these provisions to allow a potential reverse engineering exception are predicated on authorization or a licenses copy by the author. Anti-virus companies would need to demonstrate express permission of a virus author in order to initiate the reverse engineering process to create their signature databases.

Beyond this, these companies would need to convince a tribunal that the term interoperability includes creating a commercial mechanism to delete or obstruct the originating software from which it came.[9] A question that is effectively academic if they do not have authorization from the author.

4.4 Potential Exceptions to Copyright

In considering a claim of infringement by virus authors, there are several potential exceptions to justify use of their work in a commercial product. In addition to specific exceptions directly related to expressed rights presented in Section 4.3, these additional

[9] Interoperability - ability of a system to work with or use the parts or equipment of another system (Merriam-Webster)

exceptions are more over-arching in looking to provide justification for anti-virus companies in their actions or as a matter of policy protection should not be extended by society due to the effects of viruses.

As established in Section 2, copyright is a granted right by society for an author pursuant to the greater interests of society and technological advancement. Going forward, we will look at whether that extension is misguided and whether content is valid for consideration.

4.4.1 Fair Use

Under US Law, there is a potential defense to infringement under the fair use doctrine set forth in 17 U.S.C. 107, which states:

> "the fair use of a copyrighted work, including such use by reproduction in copies or phonorecords or by any other means specified by that section, for purposes such as criticism, comment, news reporting, teaching ..., is not an infringement of copyright"

Section 107 sets forth four considerations that shall be included, but not limited to, in a determining fair use regarding (1) purpose and character including commercial versus educational, (2) nature of the copyright work, (3) substantiality of portion used to work as a whole and (4) effect on the works potential market value.

Beyond these non-exhaustive factors, companies could attempt to argue researching viruses is for instructive or research intents; however, later inclusion into a commercial product undermines academic intent. Companies derive economic benefit directly from their research without compensating or acknowledging the authors.

To allow third party conduct to profit off others copyrighted works, without compensation harkens back to the Statute of Anne and subsequent copyright laws in France and the U.S., established to prevent this very activity by booksellers and publishers to the detriment of authors.

With respect to item 2, if the nature of the copyrighted work is informational, it is open to potential fair use; but if creative the threshold increases for potential fair use. For

virus source code, especially for a new variation or method of exploit, creative aspects are very high and likely not appropriate for fair use. Whether a virus is published is debatable however; the author retains that right so deference would be duly given as US courts are less agreeable to fair use for unpublished works. (17 U.S.C. Sec 106)

Per item 3, substantiality of the portion used is significant since companies freely admit it needs to be enough to detect the presence of its parent work. The actual amount of code may be small; its content is directly identifiable to its source and for simple viruses that may amount to the majority of its source code. The burden would be on anti-virus companies to establish their use as being inconsequential to the original work.

Lastly, item 4 poses a paradoxical problem for anti-virus companies. Claiming the inherent value of virus code is miniscule would require an explanation as to how they generate revenue in relying on virus code. Singularly, each virus may have little value but taken in combination, there is significant revenue. Further, viruses that are more malicious may contribute a higher worth in detecting and removing them.

Companies revenues, subsequently add credence to an author's ability to claim potential income in selling individual inoculations. An anti-virus company could not realistically claim there is not value in selling fixes when that is central to their business model.

4.4.2 Criminality

The most obvious justification for exception from copyright lies in the intended outcomes programmed into viruses. Generally, these outcomes are theft of personal information, destruction of files or system software and interference with normal usage of a computer. The straightforward argument is any infringement by anti-virus companies is for the greater good of nullifying harmful acts perpetrated on society.

The problem with relying on criminality-based reasoning is that there are no specific exceptions for criminality in any copyright act. Copyright is to protect ideas.

The Berne Convention, the WIPO Copyright Treaty, TRIPS and national legislations in the US or the EU do not contain a criminal based exception for revoking or

restricting copyright. The ability to create an exception under national law exists in the Berne 3-Step-Test (Article 9(2)), and transposed into other international treaties.

It is more practical for nations to criminalize the activity of creating a software virus as a deterrent rather than attempt a copyright exception, as many have. (18 U.S.C. § 1030, Council Directive 91/250/EEC) At present, there has not been a challenge brought forward under international agreement for a content-based software copyright exception.

Software, while termed an expression, may contain a potential effect but cannot automatically create that effect. Source code requires execution to affect society, so to blame the creation without the actions of bad actors is misguided.

To establish criminality requires criminal intent combined with an act, which separately constitutes nothing. By definition, copyright does not concern anything more than the expression of an idea.[10] Starting with the Statute of Anne and moving forward, society established copyright law to apply the instance an idea has become fixed (expressed), not prior, nor later.

The act of using software for crime is sound however; it is a backward looking determination. A crime-based exception to copyright would need to establish the execution of a crime before it happens, since software code freshly written still needs execution to function. An author could write software, objectively deemed malicious, without intent to use it but then on what basis of fairness would allow infringement of that copyright if they subsequently do not ever actually release it.

In effect, this logic would establish that the act of fixing an idea is potentially criminal, instead of the actual act of using it for criminal activity. This would undermine the entire principle of copyright, which dating back to the Statute of Anne, is to foster new ideas, not punish.

Alternatively, an exception predicated on a later finding of criminality relating to use, would require from virus authors an active responsibility to defend their work in prevention of labeling it malicious. While it may sound appealing to haul virus authors before a tribunal for possible punishment; this would set a precedence of requiring

[10] "granted by law for original works of authorship fixed in a tangible medium of expression. Copyright covers both published and unpublished works." U.S. Copyright Office

affirmative action to maintain copyright protection, on top of the already impossible task of defending their rights.

What would occur in the meantime before all appeals were exhausted? Would any economic gains need refunding? Would authors be liable after the fact for restitution to anyone injured? Would they need to defend themselves across multiple jurisdictions?

The creation of copyright was to allow authors to generate economic gain to continue creation and incentivize creation initially. Introducing an a criminal-based exception requiring time and money to defend their work to maintain their protections would predictably prohibit new authors and negate any economic gains for authors.

This would eviscerate copyright law and result in stifling creativity to the detriment of society.

4.4.3 Public Interest

Copyright is a granted balance of public interest and natural rights of authors. It would appear that virus authors take advantage of societal protection to harm society. From a policy standpoint: why respect their rights if they are abusing them.

In terms of the harm, where is the ultimate blame: virus authors who exploit software errors or software companies who produce faulty software for purchase by an ignorant public. The faults may not manifest until long after software installation and companies provide no recourse to gain refund.

For many computer users, viruses are nothing but a nuisance, existing only to harm, and aid criminal acts but as a matter of detached practicality, viruses are very beneficial even if they provide hard lessons. Exploiting programming errors or causing crashes, viruses effectively mandate that software companies produce better quality products, which they do not always do. (Liston, 2005) If they did, errors would not exist for viruses to exploit.

By forcing software companies to be more aware and fix deficiencies, virus authors are indirectly responsible for companies proactively fixing problems that may eventually have manifested to users anyway. In revealing problems on a grand scale, viruses focus

company's attention to problems with more urgency than would be accomplished by sporadic problems encountered by users in singular instances.

There is nothing to say that a programming error would not have manifested itself in a malicious manner spontaneously and there are many real world examples of software errors causing problems for people outside of a viral infection (NASA – Mars Lander).

Directly connecting malicious software to societal benefits is difficult but they do exist and from a copyright perspective, that is the heart for granting protection. To equate back to its "useful books" in the Statute of Anne, is not useful knowledge from the reaction prompted by viruses beneficial to society as a whole?

While computer users may suffer the individual damages they wreak, in the greater context of society, they lead to the benefits of more secure software, better computing systems and countless innovations resulting from improved systems. (Malin, 2008)

4.5 What Does Infringement Affect

Consider that virus authors have a valid claim of infringement which society is turning a blind eye to: why should society care? The answer to this question lies at the very core of copyright and if we ignore this situation, then society takes a large step towards unraveling the fabric of copyright.

4.5.1 Moral Rights

Article 6bis of the Berne Convention protects the integrity of authorship and the right of attribution in stating:

> "Independent of the author's economic rights, and even after the transfer of the said rights, the author shall have the right to claim authorship of the work and to object to any distortion, mutilation or other modification of, or other derogatory action in relation to the said work, which would be prejudicial to the author's honor or reputation."

The intent is to recognize natural rights to have an authors' work properly attributed to them in the form of their choosing and protect their honor and reputation. This is to respect the intellectual effort of creating new works and promote recognition irrespective of any financial rights. An author deserves recognition for their efforts even if they derive no compensation from their work.

Recognition can further enhance economic interests in increasing the value of future works. These rights bar other entities from deriving false recognition in attempting to claim works as their own for prestige or economic gain.

These moral qualities are enshrined in copyright from early laws, carrying forward as an acknowledgement by society to the worth of intellectual effort. If we choose to ignore widespread infringement by commercialized products trafficking in the efforts of authors for commercial prestige and financial gain, then society has essentially devalued authorship.

We have already seen other efforts by commercial entities to gain recognition for author's works without proper acknowledgement, and we risk efforts that are more blatant in the future such as the aforementioned Google books settlement.

4.5.2 Economic Rights

In considering the economic rights copyright reserves, there is little more to add than has already been woven into previous sections. Imagination is the only limit to innovation in creating business opportunities; however, here are some examples that a virus author could benefit from intended to steer the reader's mind away from the malicious aspects of viruses.

By allowing a monopoly for a few large companies to create one size fits all solutions at the expense of copyright, society prevents the growth of a cottage industry consisting of individual authors licensing or selling solutions to their creations. There is nothing more economically direct, than allowing authors collectively to derive income from pooling their own solutions and selling them to the public similar to a farming co-op.

This may seem like extortion however, consumers may consider it an alternative to paying potentially higher fees to anti-virus companies or spending time and money patching faulty programs.

Consider for a computer used in an offline capacity only, why force a user to pay for anti-virus protection that includes online-only viruses? Conversely, if a person does not use Microsoft Word, is it fair for them to pay for parts of anti-virus solutions designed to address Word-specific viruses? Should users who have an old computer be subject to running anti-virus software, which due to its complexity in searching for all types of viruses, slows their computer down, especially for protections they may not want/need?

It is possible that by enabling the creation of independent virus fixes, consumers would have more choices for what protections they want without being forced accept take-it-or-leave-it solutions we currently have. Whether it is better or worse is subjective but choice in general is always better for consumers.

Likewise, it may be more economically efficient and expedient for software companies to pay these authors for their fixes instead of devoting time and money to fixing it themselves. This would let companies innovate while relying on others to deal with the intricacies of errors potentially related to other applications interfering with their own products.

Another direct economic benefit is that for virus authors, the ability to use their creative works to gain regular employment with software companies. Authors who show an ability to compromise systems would be valued for a company to either teach methods to prevent errors in development phases or during quality assurance testing prior to release of their software. Several virus authors and computer hackers found employment legitimately after incarceration as security advisors and business consultants. In the competitive world of software programming, the demonstrated ability to circumvent existing software would be a notable addition to any resume. (Kevin Mitnick)

These are a few examples to consider but economic interests were an original idea that led to copyright in the beginning with the Statute of Anne. Economic interests and the ability to pursue them exist in every copyright statute, law, treaty and convention. For society now to contend that they are not important for all comers, even in creating unsavory

effect as viruses, undermines past justifications and benefits as well as present and future endeavors.

4.6 Why Claim Infringement

While there are ample grounds to assert infringement, the primary question in your mind is likely why a virus author would assert a claim of infringement. They open themselves up for prosecution under several criminal statutes and may be financially responsible for any damages their creations have caused.

Addressing the criminal aspect could encompass an entire thesis by itself but suffice to say intent would be a primary consideration since for many more mundane viruses, whether they were meant to actually do damage or fall into the "just to see if I could" variety is a point of contention. The wording of some criminal statutes would prove fertile ground for creative defense strategies

In reality, many countries enacted criminal statutes after several viruses emerged; it is difficult to accuse someone of a crime that did not exist at the time of creation. Alternatively, there have been authors caught, convicted and have served their required jail time so any fear of further prosecution would not be a factor. This does not include any statutes of limitation for applicable criminal laws that could nullify any prosecution for a previously anonymous author.

Outside of potential incarceration, two possible reasons I can contend is that virus authors in general are inclined to disrupt established social conventions. For some, an opportunity to retaliate against the companies who have made profits based on their works or prevented their works from having the full effect would be tempting. Likewise, the opportunity to subject companies to widespread investigations by government agencies as well as potential injunction orders by courts to anti-virus software would be similarly tempting.

The other reason is civil penalties potentially awarded by courts. Under Title 17, Chapter 5, §504 (b) of the DCMA, a copyright holder is eligible to actual damages and profits;

> "The copyright owner is entitled to recover the actual damages suffered by him or her as a result of the infringement, and any profits of the infringer that are attributable to the infringement"

Alternatively, statutory damages can be claimed under part (c)

> "…in a sum of not less than $750 or more than $30,000 as the court considers just"

This can be increased;

> "In a case where the copyright owner sustains the burden of proving, and the court finds, that infringement was committed willfully, the court in its discretion may increase the award of statutory damages to a sum of not more than $150,000"

As found with music and movie piracy cases, each copy is a singular instance of infringement and for a virus author could claim damages based on each copy of anti-virus sold since each contains part of their source code. (Williams Electronics, Inc. v. Artic International) The continued revenue from subscription signature databases that anti-virus companies distribute could be considered another instance of copyright violation since each successive version potentially includes prior updates.

The EU Directive 2004/48/EC on the Enforcement of Intellectual Property Rights, under Article 13(a) contains provisions for damages:

> "they shall take into account all appropriate aspects, such as the negative economic consequences, including lost profits, which the injured party has suffered, any unfair profits made by the infringer and, in appropriate cases, elements other than economic factors, such as the moral prejudice caused to the rightholder by the infringement;"

Subsection (b) provides for a royalty-based assessment of damages as if authorization had been granted by the copyright holder.

With the revenues of large anti-virus companies being in the billions of US dollars, the potential payout for just monetary considerations is potentially tremendous. Final determinations of awards rely on many variables some of which were alluded to above, such as the value of a singular virus versus the total combined worth.

Needless to say, whether a virus author would want to expose themselves to criminal liability, if they have not been subjected to it already, is something they would consider for creating a bigger disruption for computer users and software companies alike.

For some virus authors, the prestige of writing the most notorious virus or creating the largest outbreak is extremely valuable: consider the prestige of initiating an infringement claim against anti-virus companies worth potentially billions of dollars that results in an injunction against selling anti-virus products.

Copyright lasts for a lifetime and then passes to an author's heirs, so while the author may not benefit in their lifetime, their children certainly could once the copyright has passed on to them. More material for further exploration but suffice to say, the full breadth of copyright term and interests make the notion of an author staking a claim realistically possible.

5 Conclusion

From inception, copyright was to protect an author's right to gain economic reward and provide societal benefit in order to further the quest for knowledge. Over the course of time, copyright incorporated the moral rights of authors to recognize that outside of money, recognition and prestige would carry forward in time just as the knowledge they create. Any person who has ever been touched by reading a book, hearing their favorite song or watching a cherished movie or play can relate to the need society has in protecting and encouraging the intangible benefits authors provide us.

While technology has become inseparable from our daily lives, we must not embrace the new without respecting the old. As expression and creativity further expand into the digital realm, we must be mindful that in order to protect our traditions: we must respect them digitally too.

History is full of attempts to control knowledge in censoring those creations that nations found either offensive or subversive but; one man's banned book is another man's revolutionary hope. In the marketplace of ideas, all expression deserves equal protection so that society can decide as to what is successful and what is not. Content should remain a subject of consideration not a basis for censorship.

The treatment of software and all its forms is no different from past struggles with books, newspaper, music and movies. Societally, we must accept the good with the bad equally because to do otherwise undermines the protection for all. A particular expression thought good today, in the future could become bad; however, that is a matter for future generations to decide based on equal access and not hindered by past restrictions.

Software viruses may be annoying, harmful, and a drain on our time and resources but at various times in history similar charges were leveled against science, religion, music and movies all based on their content against social norms of the day. While it may be hard to see how viruses today can make things better in the future, we must still respect their

copyright protection so that possibility can exist. As with all other attempts at restricting expression, the effort related to one type inevitably turned to others. Perhaps the next great invention lies through some innovation viruses inspire and without protecting the path, society will never see it.

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